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APPLICATION

FOR

UNITED STATES LETTERS PATENT

TITLE: CLEAR PLASTIC PACKAGING IN A CMOS ACTIVE PIXEL IMAGE SENSOR

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CLEAR PLASTIC PACKAGING IN A CMOS ACTIVE PIXEL IMAGE SENSOR

[0001] The present application claims priority under 35 U.S.C. § 119 from Provisional Application number 60/111,597, filed November 18, 1998.

Field Of The Invention

[0002] The invention relates to CMOS imager devices and plastic packaging thereof.

Background

[0003] Image sensors typically are formed using some kind of clear portion to allow light photons to enter the package. Other packaging techniques use plastic injection molds, blown plastics, or plastic transfer molds.

[0004] These techniques use a flow of plastic packing compound into a cavity. The cavity includes an imager die to be packaged, on a lead frame. Once cooled, the package part is removed from the mold, and the leads are trimmed or formed to form the final packaged part.

[0005] Typical materials used in the package molding have been opaque. These materials block incoming light. Hence, when these materials are used to package an optical component, they must be used in a way that does not

interpose packaging material between the light and the component.

[0006] These prior art systems have been used with a preformed plastic cavity or leadless chip carrier. Using these forms, however, results in higher package cost.

Summary

[0007] The invention relates to packaging a photosensitive device in a clear package. More specifically, the photosensitive device can be a CMOS image sensor that is packaged in clear QFP (Quad Flat Package) or acrylic. The clear material allows the CMOS image sensor to be packaged in the same way as any other CMOS device. Since the material used to package the device is clear, the image sensor can be directly packaged in the package. This new packaging means results in lower cost devices that are more readily integrated with acrylic optics.

Brief Description Of The Drawings

[0008] These and other aspects will now be described in detail with respect to the accompanying drawings, wherein:

[0009] Figure 1 shows a chip packaging system;

[0010] Figure 2 shows an imager device in a packaging system as shown in

Figure 1 receiving incoming light; and

[0011] Figure 3 shows a double sided image sensor in a packaging system in accordance with the invention.

Detailed Description

[0012] The standard cavity mold approach used in CMOS is used according to the present application. The package is formed of clear structural plastic, such as QFP or an acrylic. Optionally, the entire package is transparent. The transfer mold approach is used in its standard way as is known in the art, but modified to use the melting and/or flow temperature for the QFP. The pressure and time in the mold are also modified according to the manufacturer's recommendations. The mold forming cavity may also be modified to allow for features and a different viscosity of the clear mold compound.

[0013] The final device 10 forms a standard type CMOS die 12 in a clear package 14 as shown in Figure 1. The CMOS die 12 is, for example, a photosensitive device, for example, an active pixel sensor, with a plurality of electrical connections 108 for electrical signal transfer. The perimeter of the packaged device has electrical connections 106, which are electrically coupled to the electrical connections 108 of the image sensor chip.

[0014] Figure 1 shows an exemplary embodiment of the package 14 of the invention and illustrates the different dimensions of the various package 10 features. As shown in figure 1, the package center 102 generally coincides with the imager array center 101. The package 14 has a number of different feature size parameters shown, including dimension "A" defining the overall package 14 width, which can be about 550 mils (0.550 inch). Dimension "B" defines an interior width of a cavity 16 for receiving the imager chip (e.g., die 12), which can be about 410 mils. Dimensions "C" and "F" define the imager chip widths, which can be about 239 mils and 224 mils, respectively. Dimensions "D" and "E" define the side lengths of the imager photo array 18, which can be about 112 mils and 92 mils, respectively. Dimension "G" defines the length of an electrical connection 106 measured from the edge of the package perimeter to the initiation of the electrical connection's 106 bend region; the dimension can be about 30 mils. Dimension "H" defines another length of the electrical connection 106 measured from the bend region to the electrical connection's 106 terminating end; the dimension can be about 15 mils. Dimension "I" defines a spacing length between adjacent electrical connection members 106 and can be about 39 mils.

[0015] As shown in Figure 2, light photons 200 impinge the photodetector 199. These photons 200 can be accumulated in the silicon substrate under the

photogate PG as 202, 204. The accumulated photons are stored as charge or some other form, which can be later read out. However, if the whole package is clear, as shown in Figure 2, then photons 200 can be received from any conceivable angle relative to the photodetector 199, such as the angle shown as 205 in figure 2. A window, which would presumably be in the area shown as 210 in Figure 2, would presumably block that photon.

[0016] Another application is shown in Figure 3. The device is packaged with two image sensor elements 300 and 310, which respectively receive incoming light from two different sides 315, 317. Another image sensor 312 can receive light from the top 320. Since the package 299 is clear, the image sensors can be freely located within the package perimeter to receive incoming light from any direction.

[0017] Other modifications are contemplated. For example, other clear materials may be usable for packaging the chip.